

REMARKS

Claims 1 through 18 are pending in this Application. Claim 3 has been amended to correct an obvious typographical error. Care has been exercised to avoid the introduction of new matter. Applicants submit that the present Amendment does not generate any new matter issue or any new issue requiring any further search and/or consideration. Further, the present Amendment places the application in better form for appeal by materially reducing or simplifying the issues on appeal. Accordingly, entry of the Amendment is respectfully requested.

The Examiner objected to claims 3-4, identifying a perceived grammatical error in claim 3. In response claim 3 has been amended addressing the perceived grammatical error, thereby overcoming the stated basis for the objection. Accordingly, withdrawal of the objection to the claims objections is solicited.

Claims 1-18 were rejected under 35 U.S.C. § 102 for lack of novelty as evidenced by Sameshima et al. (U.S. Pat. App. Pub. 2003/0203624, hereinafter "Sameshima") in view of Lukanc et al (U.S. Pat. No. 6,117,782, hereinafter "Lukanc"). Applicants respectfully traverse.

In the statement of the rejection the Examiner admitted that Sameshima fails to teach the steps of (a) forming a normal taper in the upper part of the concave of the insulating film, which is removed in part in the second polishing step of claims 1-2, 7-8 and 13-14; (b) a sacrificial layer that is formed on the insulating film and selectively removed, as required in claims 3-6, 9-12 and 15-18; and (c) forming the concave in the insulating film by etching the sacrificial film more slowly than the insulating film, as described in claim 4. Nevertheless, the Examiner asserted that one having ordinary skill in the art would have been motivated to modify the methodology of Sameshima by incorporating teachings of Lukanc with respect to the formation of a sacrificial layer and etching

technique. Moreover, the Examiner asserted that Lukanc discloses a substrate surface provided with a recess tapered at the mouth of the substrate and Sameshima discloses a two-step polishing to form damascene wiring. See pages 4-5 of the Office action. This rejection is traversed.

Applicants submit that Lukanc requires a taper as an essential structure in order to prevent formation of overhanging deposits at the corners of the opening. As described at col. 11, lines 52-57, Lunkanc discloses a structure, depicted in FIG. 4, that includes a mouth surface portion having a tapered width decreasing in size with depth below the substrate surface 4 and advantageously exhibits a substantially reduced tendency for overhang formation by the nucleation seed layer 8, relative to that illustrated in FIG. 3A. Moreover, as described at col. 12, lines 16-23, the tapered mouth surface portion, which provides a continuously increasing width at the upper portion of the recess, is able to accommodate the additional plating thickness due to increased deposition rates thereat, thereby resulting in a substantially continuously vertically oriented sidewall with a relatively sharp transition into a horizontally oriented substrate surface.

In direct contrast, the present claimed subject matter is directed to resolving the problem with parasitic capacitance and short circuit failure generated as a result of forming of a taper. Applicants submit that contrary to the Examiner's assertion, one of ordinary skill would not have been realistically motivated to combine the teachings of the references to arrive at the claimed inventions. The present claimed subject matter addresses and solves a particular problem which arises in conventional damascene processing. The particular problem addressed and solved by the claimed subject matter is that the upper part of an interconnect trench 117 is etched in the form of a taper when a diffusion barrier film 105 is removed by etching. The undesirable formation of such a taper results in a parasitic capacitance and short circuiting failures, particularly as microminiaturization proceeds apace. It is well settled that the problem addressed and solved by a

claimed invention must be given consideration in resolving the ultimate legal conclusion of obviousness under 35 U.S.C. § 103. *North American Vaccine, Inc. v. American Cyanamid Co.*, 7 F.3d 1571, 28 USPQ2d 1333 (Fed. Cir. 1993); *Northern Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 15 USPQ2d 1321 (Fed. Cir. 1990); *In re Newell*, 891 F.2d 899, 13 USPQ2d 1248 (Fed. Cir. 1989); *In re Nomiya*, 509 F.2d 566, 184 USPQ 607 (CCPA 1975).

Applicants address and solve that problem by strategically controlling the second polishing step during chemical-mechanical polishing (CMP) to remove at least a part of the conventionally formed normal taper in the upper part of a concave formed in the insulating film or of the interconnect trench (independent claims 1 and 2). In this way short circuiting is prevented. Moreover, by providing a sacrificial film on the insulating film according to another embodiment of the present invention, etching of the corner in the upper part of the concave formed in the insulating film or in the interconnect trench is prevented, and removal of a taper in the upper part of a concave or the interconnect trench is facilitated (independent claims 3 and 5).

Absent any such appreciation of the problem, it cannot be said that one having ordinary skill in the art would have been realistically motivated to modify any steps of the applied references to eliminate that problem. In this respect see *Ecolchem Inc. v. Southern California Edison, Co.*, 227 F.3d 1361, 56 USPQ2d 1065 (Fed. Cir. 2000). Moreover, the failure of the applied references to express any appreciation of this problem addressed and solved by the claimed invention constitutes evidence of nonobviousness. *North American Vaccine, Inc. v. American Cyanamid Co.*, *supra*; *Northern Telecom, Inc. v. Datapoint Corp.*, *supra*; *In re Newell*, *supra*; *In re Nomiya*, *supra*.

Based upon the foregoing it should be apparent that a *prima facie* basis to deny patentability to the claimed invention has not been established for lack of the requisite factual basis and want of the requisite realistic motivation. Moreover, upon giving due considerations to the problem

addressed and solved by the claimed invention, the conclusion appears inescapable that one having ordinary skill in the art would not have found a claimed invention as a whole obvious within the meaning of 35 U.S.C. § 103. *Jones v. Hardy*, 727 F.2d 1524, 220 USPQ 1021 (Fed. Cir. 1984).

Applicants, therefore, submit that the imposed rejection of claims 1 through 18 under 35 U.S.C. § 103 for obviousness predicated upon *Sameshima* in view of *Lukanc* is not factually or legally viable and, hence, solicit withdrawal thereof.

Based upon the foregoing it should be apparent that the objections and rejections have been overcome, and that all pending claims are in condition of immediate allowance. Favorable consideration is, therefore, respectfully solicited. If there are any outstanding issues which might be resolved by an interview or an Examiner's amendment, the Examiner is invited to call Applicants' representative at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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